GLOBAL ENGAGEMENT

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OVERVIEW

In 2020, the US faces a wide array of national, transnational, and rogue actors who seek an advantage using highly lethal, low-cost weapons. Proliferating weapons of mass destruction (and related delivery systems) with increasing range, accuracy, and lethality, pose extreme danger to North America and areas of interest abroad. *Joint Vision 2010* characterizes this environment as "challenging and uncertain," mandating that America and its coalition partners "fight as a joint team."

Looking to support *Joint Vision 2010* and national security requirements in the next decade, USSPACECOM has developed the Global Engagement (GE) operational concept (Figure 6-1). It advocates integrated focused surveillance of space, air, and surface areas–designated by combatant commanders–a defensive umbrella against missile attack, and a force application capability for certain high-priority targets. To achieve this concept, we must integrate a robust ability to surveil from space with theater air and surface-based systems to support the Full Spectrum Dominance that *Joint Vision 2010* demands.

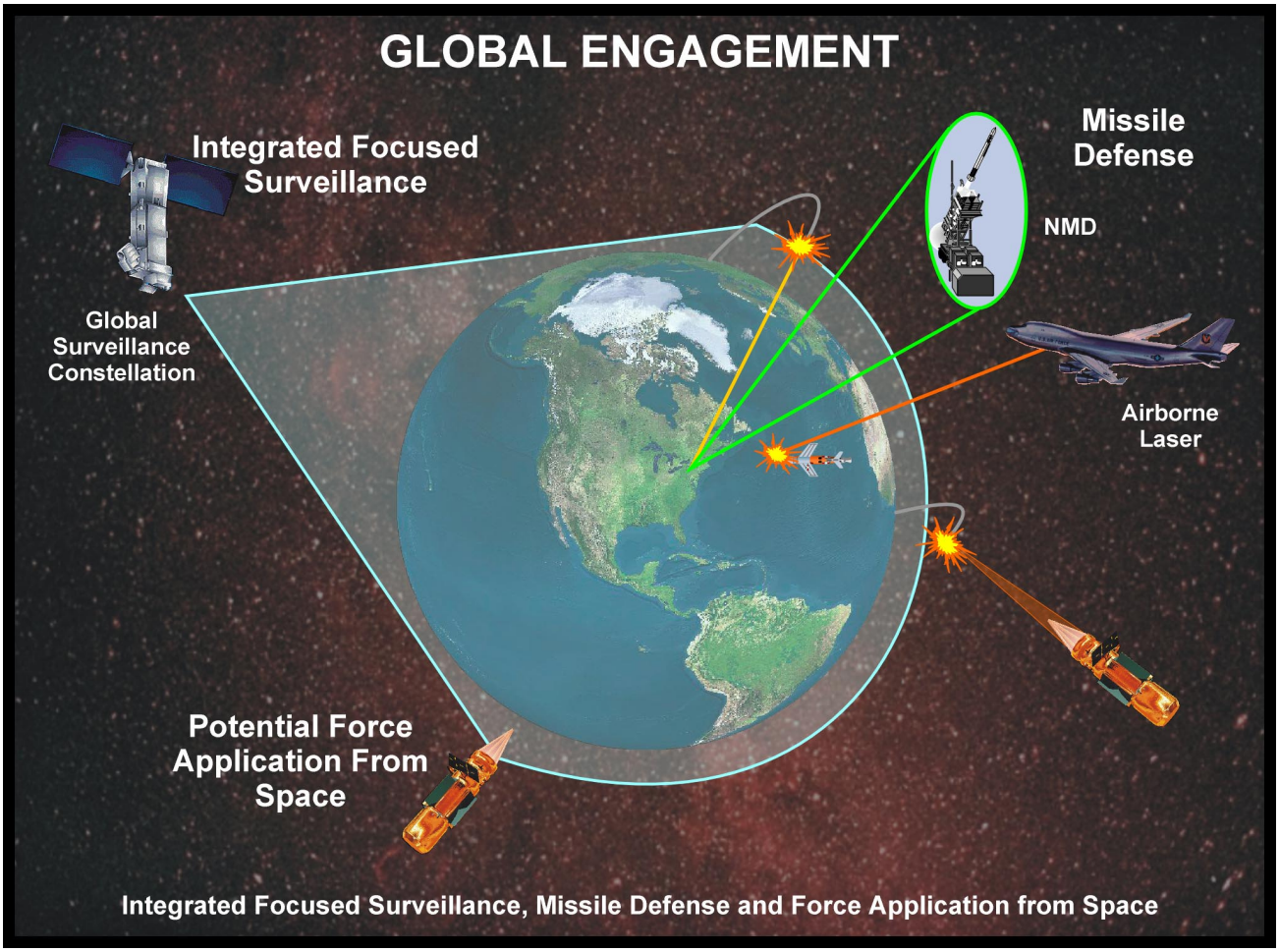


Figure 6-1 Operational Concept for Global Engagement

GE will give theater commanders greater situational awareness and more reaction time by providing an effective forward presence in space as forward basing of forces decreases. Built on information superiority, it takes advantage of leap-ahead technologies that bring unprecedented speed, flexibility, and perspective to an increasingly lethal battlespace. **At present, the notion of weapons in space is not consistent with national policy. GE provides a plan that will provide alternatives to civilian leaders if a decision is made that this capability is in the national interest.** In that event, we may need to encourage an environment of collective common security to generate the international and national political and fiscal support needed to update treaties and field systems for GE.

USCINCSPACE's vision seeks to revolutionize surface and air surveillance, missile defense, and Force Application from the ultimate "*high ground*." Its abilities will be even more dramatic than that of military aircraft decades ago. The past margin of safety for our homeland, allies, and vital interests–eroded by new, longer-range weapons–will expand again under GE.

For GE to succeed, we must integrate many systems for surveillance, warning, and command and control. Doing so will give us dominant battlespace awareness–information superiority. Combatant commanders will face adversaries who can threaten their theaters from far away, so USSPACECOM's planners envision a global defense information network–managed nationally–to integrate, process, and distribute staggering volumes of data. The data will move through battle managers that permit combatant commands to respond rapidly to threats with integrated land, sea, air, and space power.

GE faces significant challenges, including a worldwide, integrated system for command and control, surveillance of all environments day and night, the need to develop national and international space policies, and enough analysis to support critical tradeoffs of technology, systems, and architectures. Supporting Service components and DoD/National organizations will work together to meet these challenges. In the following sections, we first analyze GE's specified objectives: Integrated Focused Surveillance, Missile Defense, and Force Application. Then, we examine key tasks and capabilities, systems, CONOPS, organizations, partnerships, policies, and technologies. Finally, we assess our ability to achieve GE's goals and present directives and recommendations that will overcome shortfalls.

INTRODUCTION

GE will provide worldwide situational awareness, a global defensive umbrella against missile strikes, and global deterrence against attack with potential offensive systems that possess decisive speed and precise lethality. It is seamlessly integrated with theater land, sea, and air systems through a global defense information network. The advanced systems that will provide these capabilities must develop through extensive national, civil, and commercial partnering.

Future space systems will give commanders greater situational awareness and more time to react by providing a forward presence to complement land, sea, and air systems in theater. Global situational awareness is critical for GE. To get it, we need global systems that can operate day and night in all environments–and in real time. These surface, air, and space capabilities will allow us to dominate all engagements. Whenever a theater's assets are limited, space capabilities will provide commanders with adequate situational awareness and force options until they can put theater assets in place.

END STATE

In 2020, GE expands warning and assessment from space for missile defense, as well as intelligence, surveillance, and reconnaissance (ISR). It provides (1) worldwide situational awareness, (2) an integrated worldwide umbrella against missile attack, and (3) a limited ability to apply force from space against high-value, time-sensitive targets (see Figure 6-2).

Its most unique attribute is its availability–on-demand support for warning, surveillance, or targeting information, as well as missile defense or Force Application. All GE objectives will be executed through a USSPACECOM Battle Manager (see Figure 6-3).

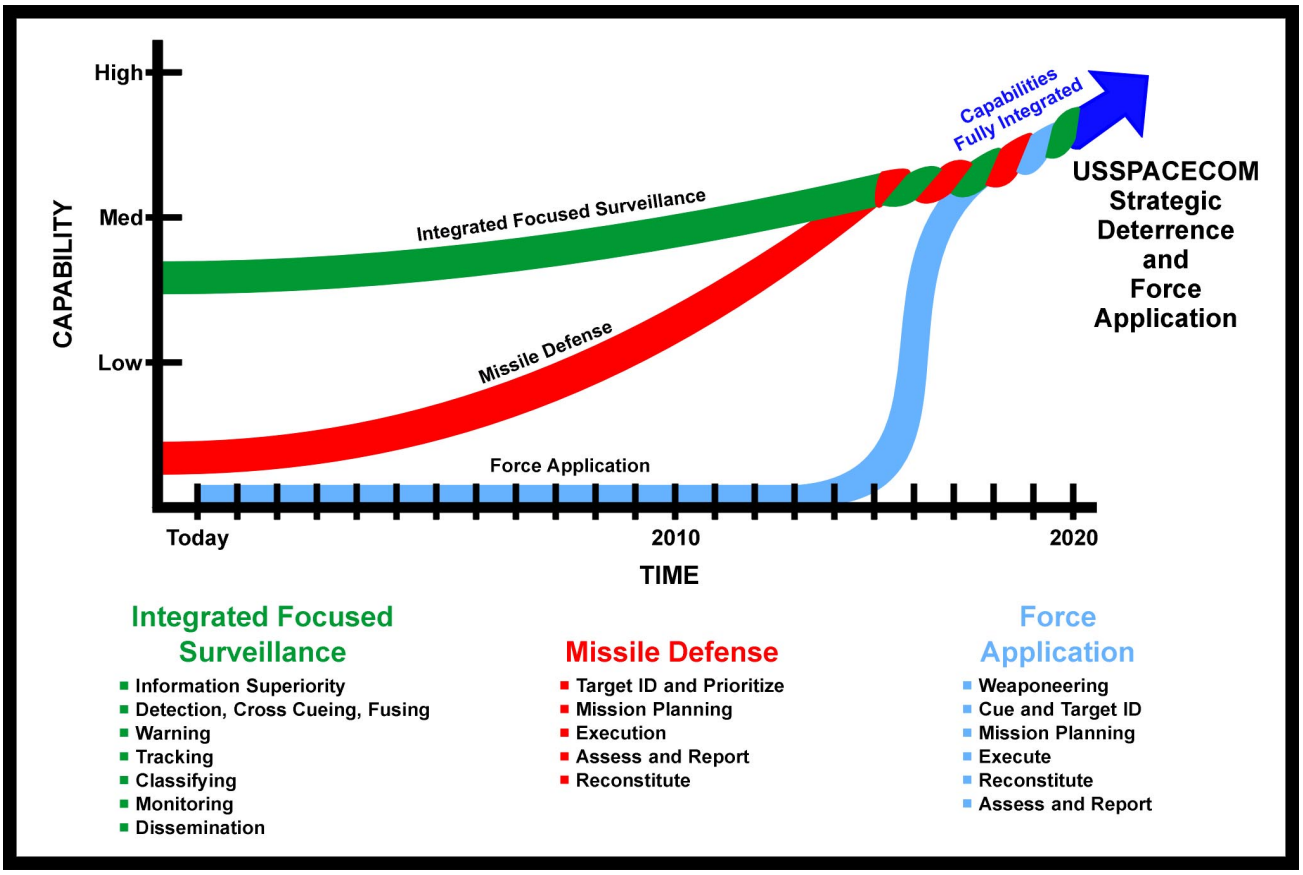


Figure 6-2 Evolution to Global Engagement

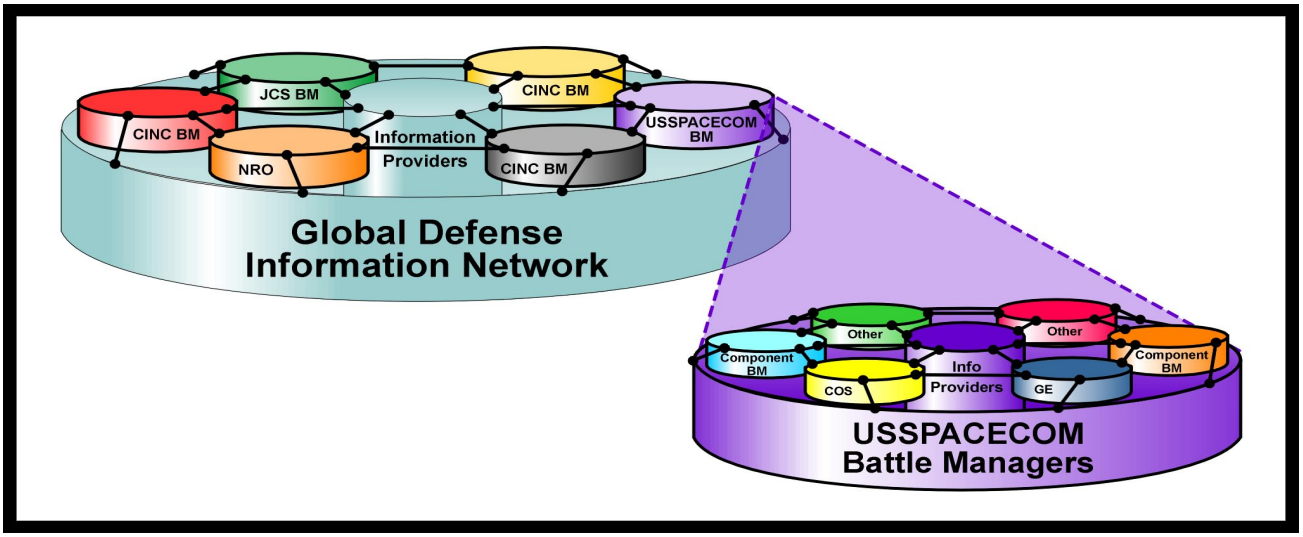


Figure 6-3 Global Defense Information Network and the Battle Managers

KEY OBJECTIVES

GE is founded on three objectives–Integrated Focused Surveillance, Missile Defense and Force Application. Each objective contains key tasks that produce key capabilities and 2020 metrics. Systems and technologies, CONOPS, and organizations must be synchronized to achieve these capabilities. Also, national policies, domestic and international partnerships, and agreements and treaties will affect

their development. Let's analyze these objectives in priority order, using the nine categories shown in Figure 6-4.

Integrated Focused Surveillance

Integrated Focused Surveillance is the cornerstone of GE. Its systems provide on-demand, continual surveillance of high-interest targets–to support missile defense and force application for all commanders. High-interest targets, as defined by the NCA and combatant commanders, will probably include key fixed, moving, buried, and relocatable targets, as well as ballistic and cruise missiles. Observing these targets will require a sophisticated system of systems sensor network with diverse capabilities that can operate in all environments and in near real-time. The need for global surveillance (anytime, anywhere) leads to space-based solutions without political or geographic constraints. Over time, many surveillance capabilities that are currently delivered by surface and air-based platforms will migrate to space-based platforms. This will occur in phases as technologies mature and are incorporated into new systems. Challenges presented by missile and air surveillance are very different than those for surveillance of fixed and moving surface targets, and may require different solutions. This will lead to families of systems that provide different space-based capabilities: one similar to Airborne Warning and Control System (AWACS) for missile and air surveillance, and another similar to Joint Surveillance Target Attack Radar System (JSTARS) for mobile and fixed surface targets. These systems will be fully integrated with comparable theater surface and air-based surveillance systems. Determining the most effective mix of surface, air, and space systems, and developing a phased plan that migrates surveillance capabilities to space will be essential to the success of Integrated Focused Surveillance. Figure 6-5 lists the key tasks, with their rationales, for Integrated Focused Surveillance.

From these tasks, we established five key capabilities for 2020:

- *Real time target identification and characterization* are required to discern 100% of the target set for missile defense, and a finite number of high interest targets for force application.
- *Ballistic and cruise missile warning* coverage will be expanded to a global basis. This is due to the proliferation of systems with increased range, lethality and precision by state and non-state actors. Low observable technology, sophisticated avionics and the spread of WMD complicate the equation.
- *Predictions* for threat missiles will be improved to deliver sub-meter accuracies for responsive defensive and attack operations.

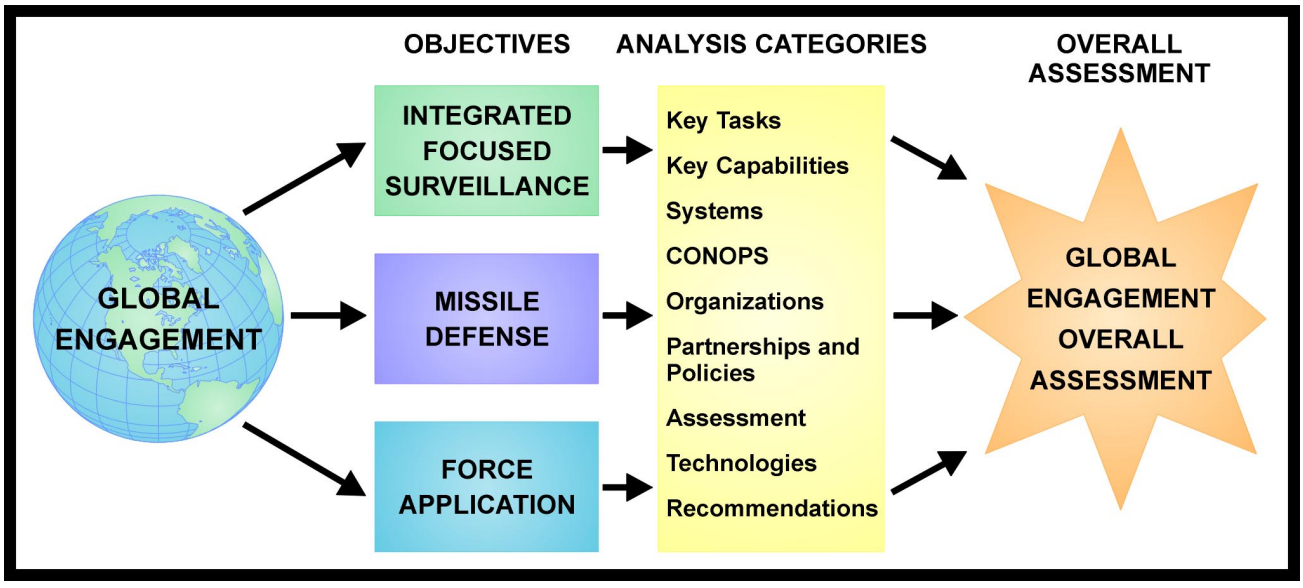
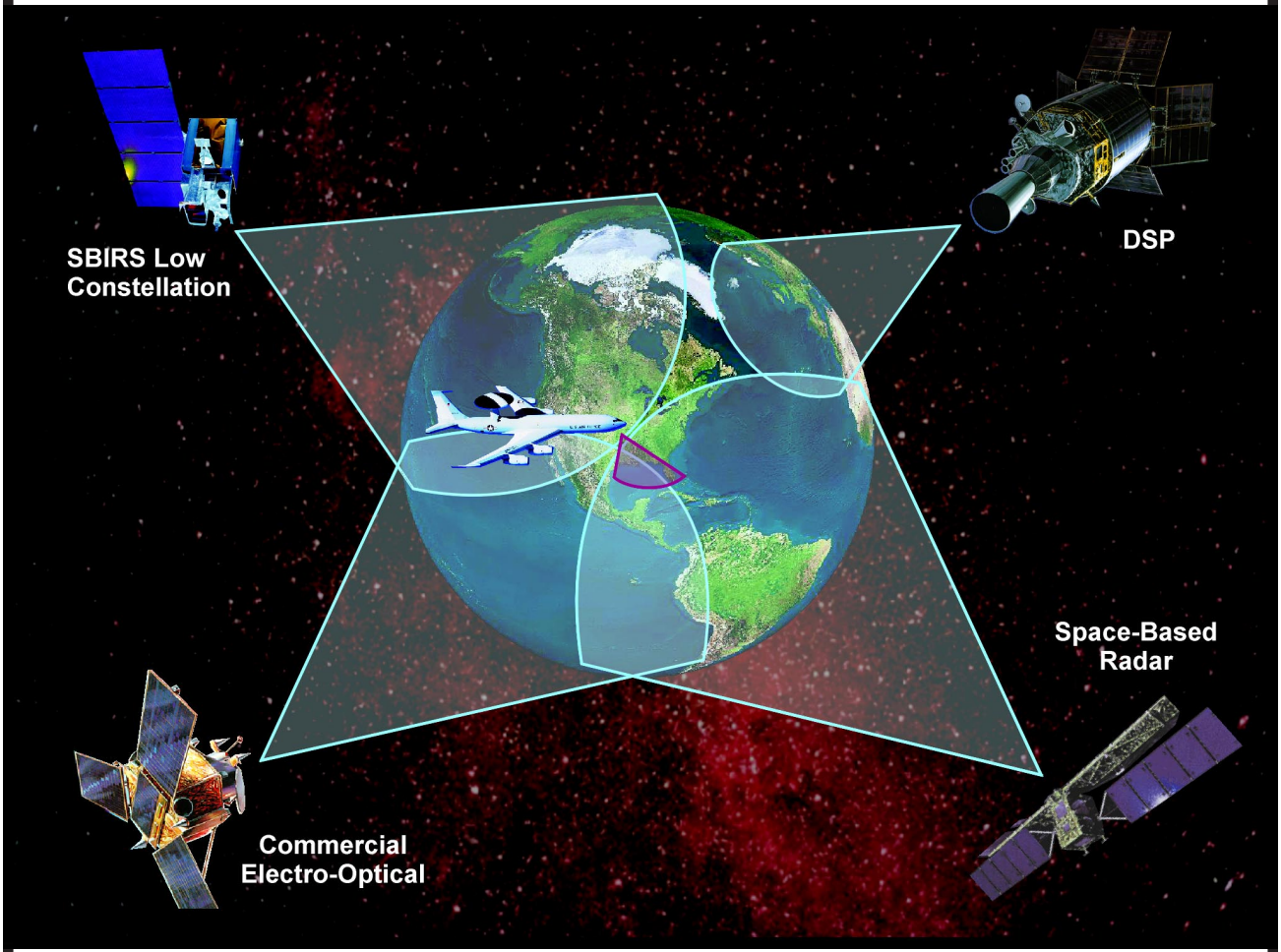


Figure 6-4 Analyzing Global Engagement

INTEGRATED FOCUSED SURVEILLANCE



- *C4ISR*–providing maximum worldwide situational awareness with all-source data from integration of land, sea, air and space systems.
- *Detecting, Cueing, Fusing*–for the detection of specific events, cross cueing of multiple systems across all mediums for specific events, near real-time fusion of data into knowledge.
- *Warning*–of air and missile threats in real-time.
- *Tasking*–automatic global tasking that optimizes sensors to targets.
- *Classifying, Characterizing, Discriminating*–Identifies and classifies targets–requires automatic target recognition.
- *Monitoring, Cataloging, Assessing*–to establish historical references for near real-time comparative analysis.
- *Tailoring*–customized products that address warfighter's specific needs.
- *Dissemination*–of near real-time support for time sensitive operations.

Figure 6-5 Key Tasks for Integrated Focused Surveillance

- *Target set detection, surveillance, monitoring, and tracking* of high interest objects in near real time is predicated on all source intelligence and is integral for both offensive and defensive time sensitive engagements. It must support all phases of targeting.
- *Battle management* for missile defense, and limited Force Application, is provided by battle managers within an overall global defense information network. This is done on a global, near real-time basis. Battle managers provide the means for the effective use of surface, air,

and space-based systems to engage the full spectrum of missile threats and selected, high interest, time sensitive targets.

Figure 6-6 depicts current abilities as well as the goal for 2020.

Figure 6-7 is an Integrated Focused Surveillance roadmap based on candidate systems and technologies provided by the Components, Services, and other agencies. Current and planned classified systems were fully considered in the development of this roadmap and as part of the system assessment discussed below. An explanation of what they do and how they fit in to the roadmap is beyond the classification level of this document.

Integrated Focused Surveillance–Systems Assessment

- *Real-Time Target Identification & Characterization (2020 goal: 100% of potential target set).* Programmed and planned systems will allow us to identify and characterize some targets in real time using national systems, Defense Support Program (DSP) satellites, early warning radars in the United States, and surface and air systems in the theaters. Advanced theater systems such as THAAD and Lower and Upper Tier will provide a much better characterization of threats for warning in limited theater areas. New national systems and SBIRS constellations will provide improved real-time identification and characterization of many surface targets and missile threats over a much larger area. Because Space-Based Radars can operate in all environments, they will greatly improve warning and ISR, but may not characterize targets well enough. Planned satellite constellations, plus surface and air surveillance, will give us real-time coverage over high-interest areas. The USSPACECOM Battle Managers and global defense information network are key supporting systems for those capabilities.

- *Ballistic and Cruise Missile Warning (2020 goal: global coverage).* Programmed and planned systems will provide partial ballistic and cruise missile warning. Current systems, such as DSP and early warning radars in the United States, do well for large, long-range, ballistic missiles, but stumble when a missile's signature decreases. They can do little about cruise missiles at low altitudes. Current theater systems provide better warning against ballistic missiles within the "point-defense" parameters of that theater, but they do little against cruise missiles at low altitudes, unless integrated with a network of elevated sensors.

INTEGRATED FOCUSED SURVEILLANCE	1998	2005	2012	2020
Key Capabilities				
• Real-Time Target Identification and Characterization	10%		50%	100%
• Ballistic & Cruise Missile Warning	AOIs, <10%			Global
• Locating Ballistic Missile Launch Point & Impact Point Prediction	10KM	Meters		Sub-Meter
• Target Set Detection/Surveillance/ Monitoring/Tracking	Days/Hours/ Minutes		Minutes/ Seconds	Real Time
• Battle Management	Limited, 10%			Near Real Time 100%

Figure 6-6 Integrated Focused Surveillance Capabilities and Goals for 2020

Integrated Focused Surveillance

Key Capabilities	Candidate Systems 98	05	12	20	Candidate Technologies
Real-Time Target Identification & Characterization (100% of Target Set)	EWR, DSP, Theater & National Systems, FBXB Radar, Lower Tier, Upper Tier, THAAD, SBIRS-High	SBIRS-Low, GE BM	SBR, GDIN, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition HIS, USI, Advanced E/O, Moving Target Indicator
Ballistic & Cruise Missile Warning (Global)	EWR, DSP, Theater Systems, FBXB Radar, Lower Tier, Upper Tier, THAAD, SBIRS-High	SBIRS-Low, GE BM	SBR, GDIN, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition, HSI and USI, Advanced E/O, Moving Target Indicator
Locating Ballistic Missile Launch Point & Impact Point Prediction (Sub-Meter)	EWR, DSP, Theater Systems, Upper Tier, THAAD, SBIRS-High	SBIRS-Low, GE BM	SBR, GDIN, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition, HIS, USI, Advanced E/O
Target Set Detection/ Surveillance/ Monitoring/ Tracking (Real-Time)	DSP, Theater Systems, National Systems, SBIRS-High	SBIRS-Low, GE BM	SBR, GDIN, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition, HSI USI, Advanced E/O, Moving Target Indicator
Battle Management (Near-Real-Time)		GE BM	GDIN, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition
CONOPS	Shared Warning, USSPACECOM BM	Global Shared Warning, GDIN, Consolidated Worldwide Surveillance			
Organizations		GE BM	USSPACECOM BM		
Global Partnerships and Policies		Commercial Imagery, Worldwide Surveillance Treaties, NASA	Global Traffic Control		

Figure 6-7 Integrated Focused Surveillance Roadmap

Advanced space-based systems, such as SBIRS High and Low, will provide improved worldwide capability against theater ballistic missiles and provide some improvement for high-altitude cruise missiles. Advanced surface and air systems such as FBXB radar, THAAD, and Lower and Upper Tier will provide much improved capability against smaller ballistic and cruise missiles. They will also expand warning from point-defense coverage to entire theaters. A

Space-Based Radar with capabilities similar to AWACS will warn against all projected threats, as long as the constellation is large enough to cover designated areas around the world and in real time.

The support that the GE and USSPACECOM Battle Managers, and the global defense information network provide for ballistic and cruise missile warning is identical to the support provided for real-time target characterization.

- *Locating Ballistic Missile Launch Point and Impact Point Prediction (2020 goal: sub-meter accuracy).* Programmed and planned systems will be adequate. Current systems are accurate within kilometers, but advanced theater systems (THAAD, Upper and Lower Tier, and ABL) will be accurate to one meter within theaters. The SBIRS constellation will provide meter-level accuracy on a global basis with its detection capability. A space-based radar capability will provide global coverage for the entire threat spectrum at meter to sub-meter accuracy. The USSPACECOM Battle Managers and global defense information network will integrate land, sea, air, and space systems for all commanders. In addition, it will provide real time updates on navigation and geo-location systems (such as GPS) that warning systems will be using for precise launch point location and impact prediction.

- *Target Set Detection, Surveillance, Monitoring & Tracking (2020 goal: near real time).* Programmed and planned systems will cover some of these goals, expanding today's limited ability. Current national systems aren't timely and don't always work in inclement weather. Theater systems have limited coverage. DSP has good coverage but is ineffective against surface and air targets. Future national systems and the SBIRS constellations will provide better coverage and capability. Space-Based Radars will strongly improve this capability. They'll meet a critical requirement by working day or night in all kinds of weather, much like JSTARS. With Space-Based Radars, the family of systems will meet all requirements, as long as the constellations are large enough. The USSPACECOM Battle Managers and global defense information network provide the same support for this capability as they do for locating launches and predicting impact points.

- *Battle Management (2020 goal: near real time).* Programmed and planned systems will meet battle management goals. Today's command and control systems aren't integrated and can't digest the large amounts of data that future systems will produce. They don't give all commanders common operating pictures, analysis and planning tools, or decision support aids. Neither do they integrate surface, air, and space elements of a battle. The USSPACECOM Battle Managers will cue, fuse and correlate information from all space systems. It will also provide the status of space forces, planning tools, decision aids, and execution paths for all commanders. The global defense information network will integrate the USSPACECOM Battle Managers with other battle managers around the world. It will distribute tailored information from all sources at multiple security levels and support the rigorous joint and combined training, testing, and exercising needed to carry out integrated operations.

Integrated Focused Surveillance–CONOPS, Organizations, Global Partnerships and Policies

To provide effective guidance and structure for crucial systems, CONOPS must lead away from stovepiped thinking and foster integrated land, sea, air and space operations. Requisite concepts include shared warning, USSPACECOM Battle Managers, and consolidated worldwide surveillance.

The Shared Early Warning CONOPS guides how to send data on missile warning from theaters to select allies. Because global defense information network will work at several security levels, this will expand to a Global Shared Warning CONOPS. Currently, we have strategic, theater, and shared warning that use separate systems and procedures. In the future, we'll have a common approach that uses the global defense information network to provide tailored warning information and standardized procedures to US and allied forces. The concept for USSPACECOM Battle Managers is also crucial and will bring together a variety of systems to create Integrated Focused Surveillance, so all commanders and decision makers can use the

results. Finally, as advanced surveillance systems begin operating near 2020, a Consolidated Worldwide Surveillance CONOPS must be developed to integrate surface, air, and space systems from cradle to grave.

Organizations must keep pace with advanced systems and concepts, especially for the global defense information network. Divisions along traditional lines, such as centers for missile warning, space control, and air-defense operations, limit our flexibility and efficiency in completing a mission that must become more integrated.

Integrated Focused Surveillance could benefit strongly from three key partnerships that would (1) integrate commercial imagery, (2) develop dual-use technology with NASA's Mission to Planet Earth, and (3) develop a dual-use system for tracking aircraft with the FAA.

Emerging civil, military, and commercial space systems give us the chance to dramatically increase efficiency and decrease development and operational costs with dual-use systems. New space-based sensors are already being fielded. US and foreign companies will soon market imagery accurate to one meter. New generations of remote-sensing satellites will produce multi-spectral imagery at a much higher resolution than the current LANDSAT and SPOT systems, and Canada is already marketing its new radar-imaging satellite as a commercial project. Incorporating these products into Integrated Focused Surveillance by 2005 could save scarce resources to apply in other areas.

One of NASA's core programs is the Mission to Planet Earth. This program coordinates an aggressive international effort in remote sensing. It will produce data so environmental scientists can better understand the complex interaction of our planet's land mass, hydrosphere, and atmosphere with space. The challenge of collecting, archiving, cross-referencing, and distributing information is similar for Integrated Focused Surveillance and Mission to Planet Earth. Large segments of the civil and commercial sector could benefit from generic capabilities such as automatic signature recognition, database archiving, and cross-referencing. Weather research and forecasting, banking and investment experts, agriculture, medicine, manufacturing, and education are just a few examples of how commercial applications can grow from government programs. Shared development of these capabilities during the first decade of the next century could strongly influence political and economic support for Integrated Focused Surveillance–a critical enabling concept for GE.

A potential key civil and military dual-use partnership is a global space-based tracking system for domestic and international civil aviation traffic control. By 2020, this capability could replace ground-based radars, improve aviation safety, and increase international stability while reducing operational costs. There may be commercial applications as well. In the future, companies may see aircraft as part of a system that includes command and control (tracking) and use this capability to obtain marked improvements in safety as the number of airlines increases. Based on a Space-Based Radar with moving target indicator, this partnership could become as powerful and important as GPS is today. Partnerships in this area would build broad political support and a solid industrial and economic base for Integrated Focused Surveillance.

Integrated Focused Surveillance–Overall Assessment

Capabilities under development for Integrated Focused Surveillance should support all missions by 2020, so we've rated this area GREEN. By 2020, technologies will emerge to provide day and night coverage in all environments within high-priority areas (see Figure 6-8).

Three pivotal items emerge from this analysis. We must have a global defense information network for Integrated Focused Surveillance to be effective. This network integrates space systems with surface and air systems, and resolves tasking, cueing, and distribution issues for the NCA and all commanders. Space-Based Radars will strongly improve coverage in all weather, day and night. Although other technologies like ultra-spectral sensors exist, we expect that Space-Based Radars will expand coverage in this critical area and move Integrated Focused Surveillance to a GREEN rating. It must be acknowledged, however, that stealth and advanced counter-surveillance technologies may degrade these abilities.

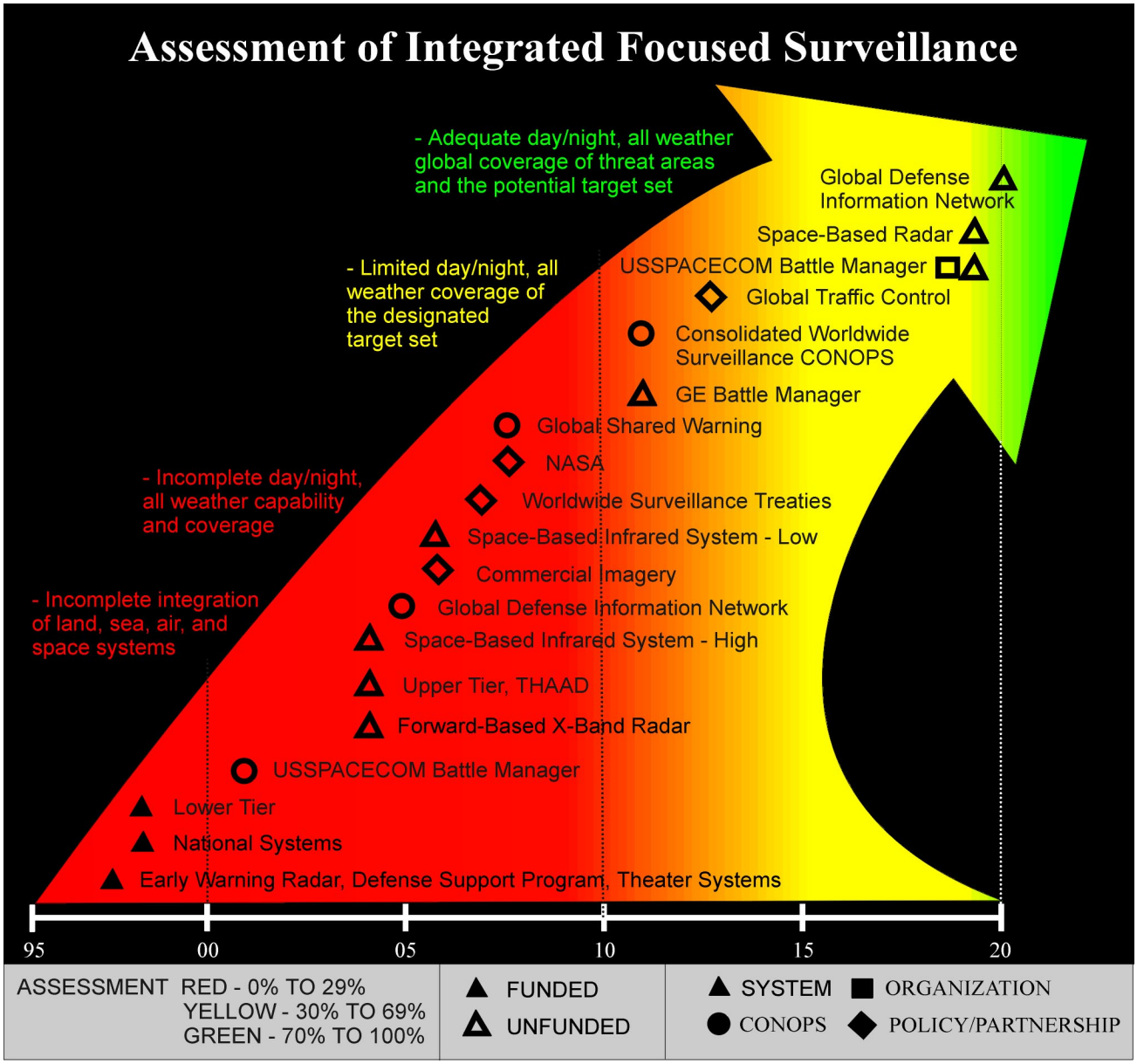


Figure 6-8 Assessment of Integrated Focused Surveillance

Integrated Focused Surveillance–Technology Assessment

The systems needed to satisfy requirements for Integrated Focused Surveillance haven't been defined, but experts from the Components, Services, and other agencies believe certain technologies need to be explored, refined, and developed.

Space-based sensors for surveillance require new technology to rapidly and accurately detect, identify, characterize and track targets. Electro-optical, spectral, and synthetic aperture radar are just three types of sensors that could do these tasks. All need further development to produce a robust constellation that can detect and report targets in near real time under all conditions.

Electro-optical and spectral sensors must be lightweight and have high signal-to-noise ratio characteristics requiring advanced optics, dispersion elements, focal planes, and processing segments. For synthetic-aperture radar sensors, using high-power antennas, we need lighter transmit/receive modules and highly efficient amplifiers.

Advanced surveillance sensors demand much more of spacecraft: greater power, precision pointing, and lightweight rigid structures. Spacecraft may

also need to process data onboard. This will require robust, reconfigurable, radiation-hardened processors, real-time capabilities, advancements in high-speed processors, models for using data, cross cueing techniques, and fusion technologies.

Work is already underway to develop a family of surveillance satellites that could provide some of the required capabilities, but the space segment is just one piece of the architecture needed for Integrated Focused Surveillance. The global defense information network, for example, must fuse and manage information from all sources.

USSPACECOM should stay involved in ongoing studies of surveillance within DoD. The requirements documents derived from these studies will play a key role in achieving our 2020 goals. Trends in surveillance technologies suggest we could get what we need if we have:

- A detailed space study that leverages technologies commercial industry could deliver (e.g., information, communications, data fusion).
- Focused cooperation and sharing among the DoD, civil agencies, and allies on technologies unique to the military. If not, the capability will be too expensive.

Integrated Focused Surveillance–Recommendations and Directives

We must achieve Integrated Focused Surveillance before completing Missile Defense and Precision Strike. To realize 2020 goals for this area, USCINCSPACE must:

(**Directive/Recommendation**) Advocate operational requirements and priorities, emphasizing sensors that work day and night in all environments. (SPJ5)

(**Directive/Recommendation**) Advocate wide-area, global coverage. (SPJ5)

(**Recommendation**) Support development of technology for automatically recognizing and characterizing targets. (N-SPJ2, SPJ3/5)

(**Directive/Recommendation**) Coordinate with other CINCs, Components, and Services on concepts for a global defense information network to make sure it's compatible with similar systems that support Joint Warfare. (SPJ3, N-SPJ6)

(**Recommendation**) Support development of multilevel security capabilities. (N-SPJ6)

(**Recommendation**) Support development of dual-use technologies and systems. (N-SP/AN, SPJ3/5, N-SP/J6)

(**Directive**) Establish a dialogue with NASA, the NRO, and other stakeholders to develop a phased migration of surveillance capabilities to space platforms for air and missile surveillance, as well as surface surveillance, and to determine the mix of surface, air, and space platforms that provides the most effective capability for the end users. (N-SPJ2, SPJ3/J5)

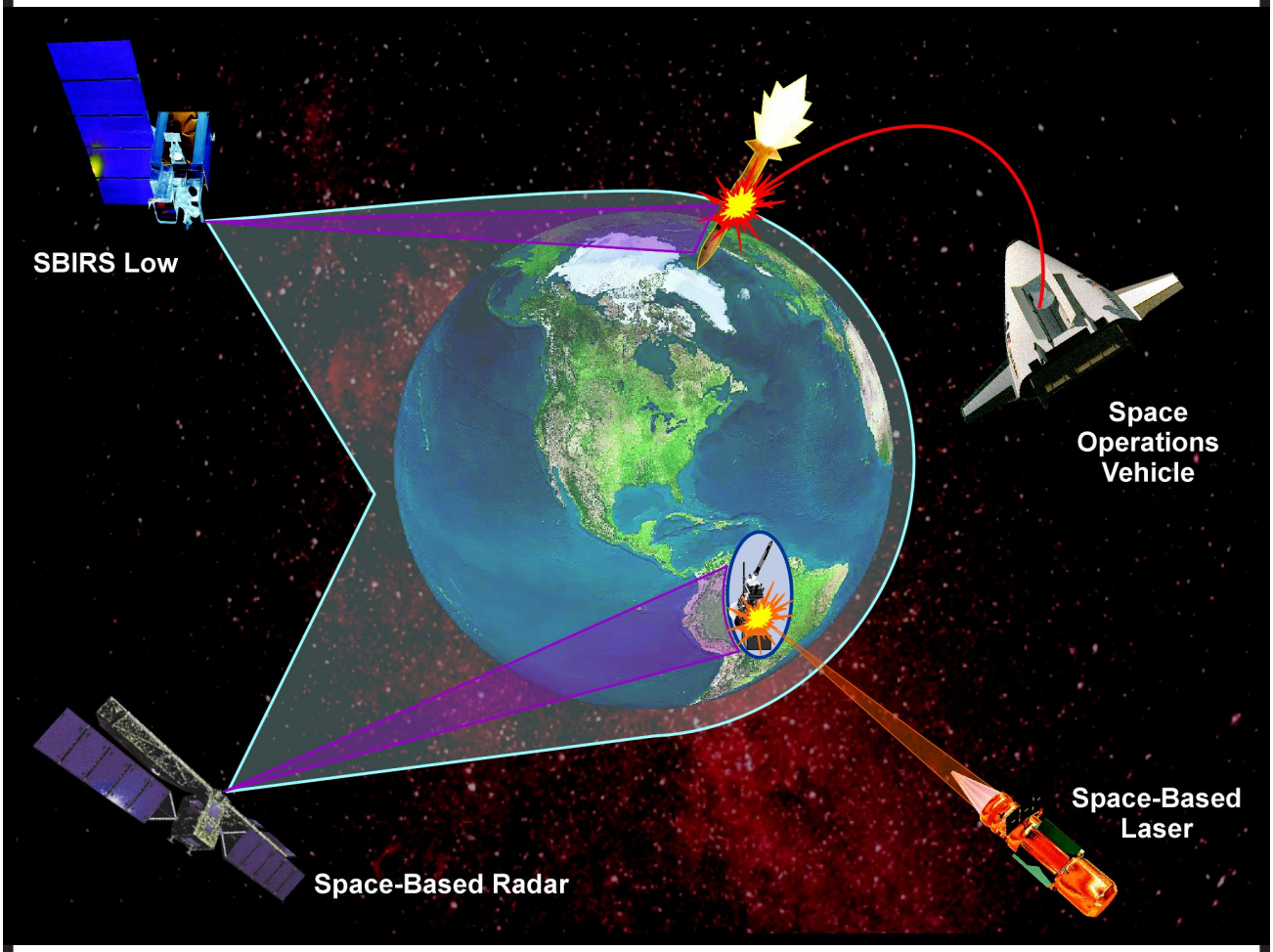
Missile Defense

Missile Defense protects against ballistic and cruise missiles threatening forces and vital interests of the US and our allies. This task becomes more difficult as systems are able to deliver weapons of mass destruction with increased range and lethality. Countering the worldwide threat of cruise missiles at low altitudes will be particularly challenging. But if we can field effective systems and use them in concert with theater capabilities, we'll also be able to counter other high-value airborne targets, such as aircraft and Unmanned Aerial Vehicles. As with Integrated Focused Surveillance, Missile Defense must integrate seamlessly with theater systems for all commanders and decision makers. Figure 6-9 lists the key tasks for Missile Defense.

Based on the tasks in Figure 6-9, we've identified four key capabilities for Missile Defense in 2020:

- *Battle management* must fuse information so we can engage missile threats and related high-interest, time-sensitive targets in near real time.
- *On-demand missile defense,* which must deploy and respond to rapidly developing situations worldwide.
- *Full spectrum engagement,* which is the ability to engage targets throughout all phases of flight (before launch, limited Force Application may destroy those targets).
- *Combat assessment* requires automatic evaluation of engagement results and enables immediate reengagement, if necessary.

MISSILE DEFENSE



- *Target Identification And Prioritization*–of high value target areas and homeland defense.
- *Mission Planning*–fully integrates surface, air and space-based systems via the Global Defense Information Network (GDIN).
- *Execution*–reliable command links under compressed cycle times and complex environments.
- *Reconstitute*–forces, particularly space forces to assure continued global coverage.

Figure 6-9 Key Tasks for Missile Defense

Figure 6-10 shows how we do these four things now, as well as the goal for 2020.

Missile Defense–Systems Assessment

Figure 6-11 shows a missile defense roadmap based on candidate systems and technologies the Components, Services, and other agencies provided.

- *Missile Defense BMC3 (2020 goal: 100%).* By 2020, the USSPACECOM Battle Managers and global defense information network will fully integrate defense systems (surface, air, space) for all commanders and decision makers.
- *On-Demand Missile Defense (2020 goal; global protection within minutes).* Programmed and planned systems will meet the 2020 goals. Current systems, such as PAC-3 and Aegis, provide point defense for theater threats within days. Ground-Based Interceptors, derived from NMD, and Ground-Based Lasers will meet timeliness requirements for some threats of large ballistic missiles in North America. Advanced theater systems for surface and air–such as THAAD, Lower and Upper Tier, and ABL–will expand coverage from point defense to area defense, but they'll do little for response time.

MISSILE DEFENSE	1998	2005	2012	2020
Capabilities				
• Missile Defense Battle Manager for C3	TMD-10%			TMD/NMD-100%
• On-Demand Missile Defense	Days-Point Defense		Hours/ Minutes	Global
• Full Spectrum Engagement	10%			All Phases
• Combat Assessment	10%			100% Real Time

Figure 6-10 Missile Defense Capabilities and Goals for 2020

Missile Defense

Key Capabilities	Candidate Systems 98	05	12	20	Candidate Technologies
BMC3 (100%)		GE BM	GDIN, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition, HSI, USI, Advanced E/O, Moving Target Indicator
On-Demand Missile Defense (Global) (Minutes)	PAC-3, Aegis, Lower Tier, GBI, GBL	Upper Tier, THAAD, ABL, GE BM	SBL, GDIN, SOV, HPM, USSPACECOM BM		Ballistic Missile Replacement, High Power Microwave (HPM)
Full Spectrum Engagement (All Phases)	PAC-3, Aegis, Lower Tier, GBI, GBL	Upper Tier, THAAD, ABL, GE BM	SBL, GDIN, SBP, SOV, HPM, USSPACECOM BM		Ballistic Missile Replacement, HPM
Combat Assessment (100%) (Real-Time)	PAC-3, Aegis, Lower Tier, GBI, GBL	Upper Tier, THAAD, ABL, GE BM	SBL, GDIN, SBP, SOV, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition, HSI, USI, Advanced E/O
CONOPS	Shared Warning, USSPACECOM BM	Global Shared Warning, GDIN			
Organizations			USSPACECOM BM		
Global Partnerships and Policies	Shared Warning, Space Weapons Policy	Global Shared Warning, ABM Treaty	Missile Defense Treaties		

Figure 6-11 Missile Defense Roadmap

The Space-Based Platform (formerly the Space-Based Interceptor) and Space Operations Vehicle will defend against missiles worldwide, responding in hours. Space-Based Lasers will reduce response time to minutes. USSPACECOM Battle Managers and global defense information network are critical to this capability.

- *Full Spectrum Engagement (2020 goal: all phases).* Programmed and planned systems will meet these goals for 2020. Current missile defense systems can engage only theater ballistic missiles in the terminal phase of flight. Lower Tier will expand this point-defense envelope for theater threats, and Ground-Based Interceptors and Ground-Based Lasers will destroy some large missiles targeted on North America in the terminal phase. Upper Tier and THAAD provide area defense against theater threats, and Airborne Lasers will engage theater threats when they are in powered flight.

  The Space-Based Platform and Space Operations Vehicle will enable weapons that will engage ballistic missiles in their boost, midcourse, and final phases, as well as cruise missiles at most altitudes. Space-Based Lasers will do better. The USSPACECOM Battle Managers and global defense information network must allow commanders with forces at risk to select and use the proper weapons and, if the threat isn't neutralized, continue the engagement. They will also update all commanders and decision makers on system readiness and replenishment.

- *Combat Assessment (2020 goal: 100%, real time).* Programmed and planned systems will reach 2020 goals. Most missile-defense systems can assess battle damage after an engagement with limits similar to those for full-spectrum engagement. Current systems, such as PAC-3 and Aegis, have limited coverage and capability to determine battle damage. Advanced theater systems will expand coverage and better define target damage. Early "strategic" systems, such as Ground-Based Lasers and Interceptors, will start us in the right direction. The Space-Based Platform, Space Operations Vehicle and Space-Based Laser will add to these capabilities. USSPACECOM Battle Managers and global defense information network will provide vital combat assessments for commanders and automated cross cueing for sensors and defense systems.

Missile Defense–CONOPS, Organizations, Global Partnerships and Policies

A key CONOPS for Missile Defense is USSPACECOM Battle Managers which parallels the concept for Integrated Focused Surveillance. As the global defense information network develops, it must integrate the capabilities, planning requirements, and execution needs of all surface, air, and space-based missile defense systems. It must support all commanders and decision makers. The US supports shared-warning systems for some allies, but we must have a global warning system to support the missile defense partnership described below.

The USSPACECOM Battle Managers and global defense information network must work across traditional boundaries in more flexible, integrated organizations.

Today, policy for military space systems resembles that of aviation at the beginning of the 20th Century. In 1899, before airplanes were invented, the Hague Peace Conference banned them from combat; but countries ignored this restriction during World War I. In 2020, regional instability, terrorism, and the proliferation of accurate, long-range weapons, capable of mass destruction, may present as great a challenge to the world community as strategic nuclear weapons did during the Cold War. National policy and commitments to treaties on antiballistic missiles permit us to deploy only limited systems to counter large strategic threats but allow deploying robust systems to counter theater threats. To counter these threats worldwide, especially when theater systems are absent, we need space-based capabilities. We must investigate candidate technologies so options will be available when called for. Treaties that maintain stability and strategic balance during the Cold War may need to change if we are to maintain world security in 2020.

Peaceful nations must prudently guard against the threats described above but unilateral action may appear aggressive and hostile. Strong coalitions and collective security arrangements should address regional instability, terrorist actions, the proliferation of weapons of mass destruction, and sophisticated,

long-range delivery systems. Such arrangements will provide strong political and economic support for a new generation of agreements and treaties that normalize space operations.

Missile Defense–Overall Assessment

Developing capabilities should meet all requirements for Missile Defense by 2020. Theater systems will cover some geographic areas, and space-based systems will provide global coverage. Analysis reveals that we need several pivotal systems and should address two critical issues concerning policy and partnerships.

Ground-Based Interceptors, Space Operations Vehicles, Space-Based Platforms and Lasers, and High Power Microwaves are crucial. If we add the Ground-Based Interceptor to theater defense systems, we can marginally satisfy this mission in 2003 (rated YELLOW).

If we add Space Operations Vehicles and Space-Based Platforms to the mix, we can move to a GREEN rating by 2008 to 2012. These systems will use similar, possibly identical payloads, so they're basically different platforms for the same weapon. Since scarce resources may not permit funding of both, this may result in a decision point between the two planned concepts.

The Space-Based Laser and High Power Microwave will use directed energy to strike nearly all potential targets. Because both are large and expensive, we may need to choose one. Fortunately, they're just beginning to develop and won't deploy before 2018 or 2020. By 2005, we should have enough information to analyze tradeoffs and decide between them, if necessary.

Eventually, leaders may need to review national policy on space-based weapons, particularly

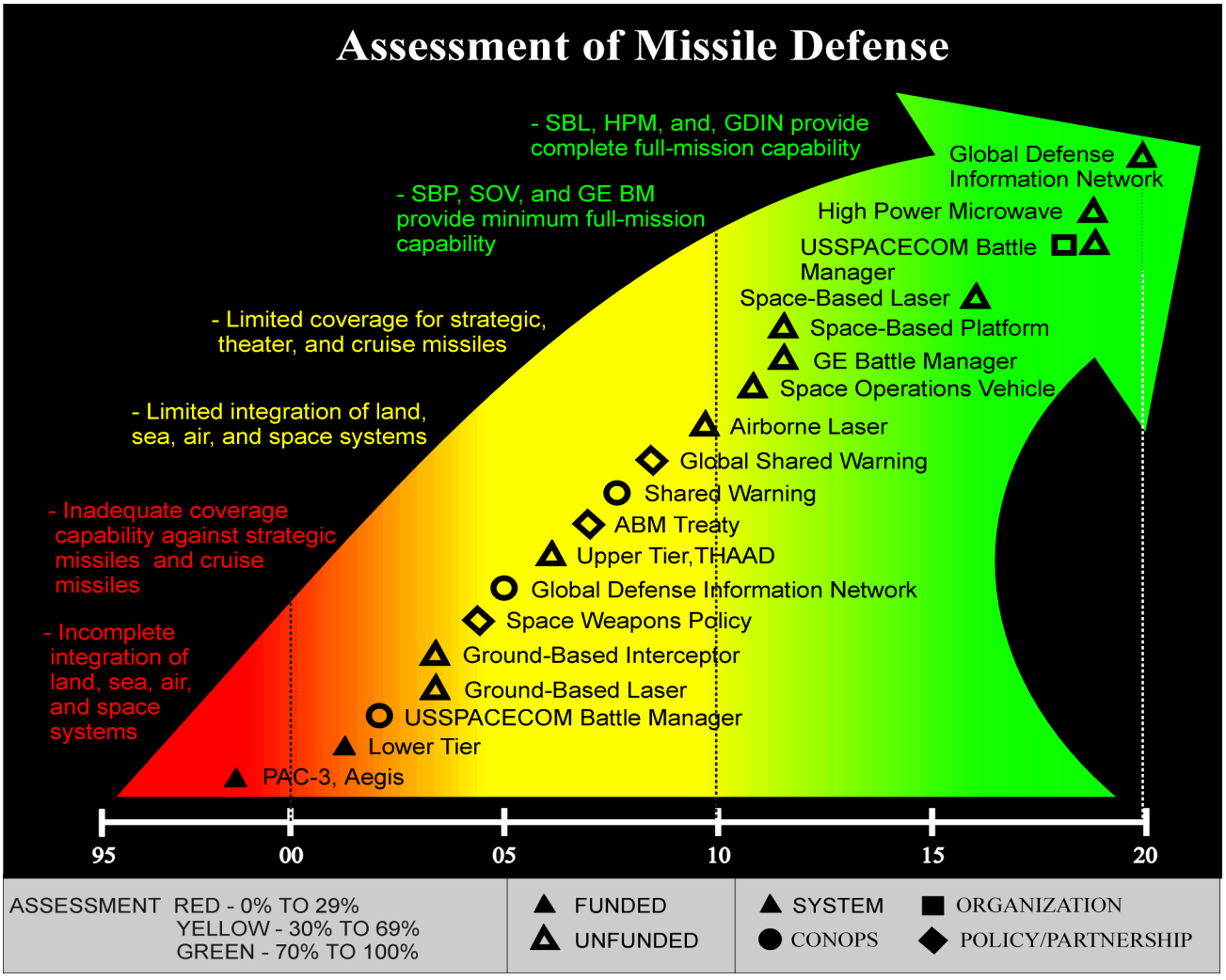


Figure 6-12 Assessment of Missile Defense

related to the ABM Treaty. Politics after the Cold War make this difficult, but emphasizing the benefits of coalition action and collective security should gradually build support for it.

Missile Defense–Technology Assessment

Assets for Integrated Focused Surveillance also support Missile Defense. Today, we're emphasizing defense against theater ballistic missiles. National Missile Defense considers defense against large ICBMs and SLBMs. We'll have to include cruise missiles in the future but the space segment won't have to do it all. Instead, it will be part of a worldwide, integrated system for Missile Defense based on the ground, in the air, and in space. Defenses will operate in tiers to serve all commanders and will engage missiles in all phases of flight.

To defend against missiles, we must find a way to detect threats quickly in land, sea, air, and space environments, as well as during all kinds of weather. New sensor and imaging technologies are described in the previous section on Integrated Focused Surveillance.

Engagement options range from conventional to kinetic and directed energy weapons based in all mediums. Technical challenges for space-based systems include weight constraints, adaptive optics, and beam control. Laser weapons similar to those described in the chapter on Control of Space may apply to Missile Defense, but they must get much better at tracking and intercepting targets. Kinetic weapons also face technical challenges: developing and integrating miniaturized guidance, continuous control, actuation technology, applying advanced composites to high-performance propulsion systems, controlling fires, improving their penetrating power, and improving propulsion.

Integrating missile defense technologies may be the greatest challenge and requires a global defense information network and a USSPACECOM Battle Managers as part of this system.

Commercial solutions are advancing quickly, especially in telecommunication and computing, so the US military should be able to leverage them at relatively low cost. We should have an infrastructure for limited Missile Defense by 2020 if we follow current development paths and partner with organizations outside the DoD.

Missile Defense–Recommendations and Directives

Missile Defense restores the margin of safety for our homeland, allies, and vital interests. USCINCSPACE must address key issues on resources, requirements, and policies to achieve 2020 goals:

(**Recommendation**) Establish a dialogue with appropriate government organizations on space policy. (SPJ5)

(**Directive/Recommendation**) Develop a "nodal analysis" of the technologies contained in this Long Range Plan. (N-SP/AN, All Components)

(**Directive**) Define and help in cross-fertilizing the Components' technology efforts. (N-SP/AN, SP/3/5)

(**Directive/Recommendation**) Work with Components and other CINCs to develop, test, refine, and exercise rules of engagement across theaters and to fully integrate space systems into theater and JTF operations. (N-SP/AN, SPJ3/5)

(**Directive**) Update IPL to establish clear priority for candidate systems that provide key capabilities. (SPJ5)

Force Application

"Department of Defense shall maintain a capability to execute the mission areas of space support, force enhancement, space control and **force application**."

National Space Policy

USCINCSPACE responsibilities include:

- "**Advocating** space (including force enhancement, space control, space support, and **force application**) and missile warning requirements of other CINCs.
- **Conducting space operations by exercising combatant command over** assigned space control, space support (including launch and on-orbit operations), and force enhancement forces, as well as **forces that provide strategic ballistic missile defense for the United States**."

–excerpts from 1998 Unified Command Plan

From its inception in 1985, USSPACECOM has been directed by the Unified Command Plan (UCP) to plan for and develop requirements in support of engaging ballistic missile attacks on the United States. There are potential space-based solutions to this very difficult national missile defense challenge. If our country were to pursue research and development of these space-based options, they would also offer attributes for the engagement of time-critical, very high value targets (besides BMD) anywhere in the world. Force Application could hold a finite number of targets at risk anywhere, anytime. In support of direction by the National Space Policy and Unified Command Plan, this Long Range Plan examines the possibility of force application in some detail.

AT PRESENT, THE NOTION OF WEAPONS IN SPACE IS NOT CONSISTENT WITH US NATIONAL POLICY. PLANNING FOR THIS POSSIBILITY IS THE PURPOSE OF THIS PLAN SHOULD OUR CIVILIAN LEADERSHIP LATER DECIDE THAT THE APPLICATION OF FORCE FROM SPACE IS IN OUR NATIONAL INTEREST.

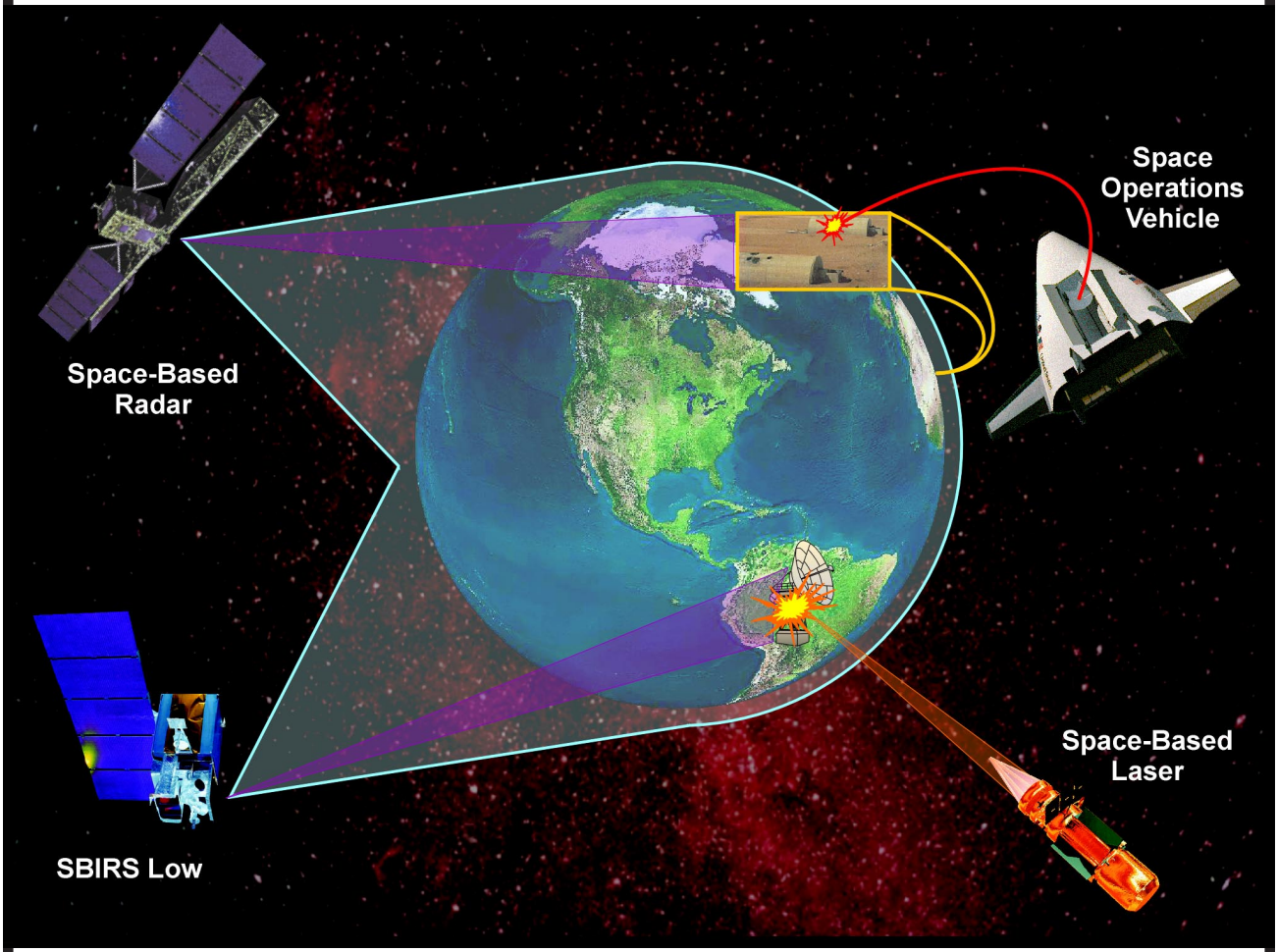
Many of the systems and concepts for Missile Defense may have applicability to Force Application. This concept envisions holding a finite number of targets at risk anywhere, anytime with nearly instantaneous attack from space-based assets. This concept will add options for deterrence and flexibility for the NCA. It will offer reduced risk, increased speed, and short cycle times to counter some high-value targets that may threaten US and allied forces and interests. Thus, the NCA may need at its disposal a means of engagement, in the form of Force Application from space, to neutralize threats without widespread destruction. The ability to apply force from space may employ orbital systems or ground-based systems. Force Application may be optimal when time is absolutely critical, risk associated with other options are too high or when no other courses of action are available. National and possibly coalition support for this concept will likely precede any research on capabilities deployment. Policies, doctrine, treaties, CONOPS, and command and control issues for Force Application may be more restrictive than those previously discussed for Missile Defense.

Seven military tasks are envisioned to be essential for the future employment of Force Application. One of these, cueing, is also a key task for Integrated Focused Surveillance. Five others–identifying targets, mission planning, executing, reconstituting, and assessing and reporting–are identical to the similarly named key tasks for Missile Defense. The remaining task is weaponeering (see Figure 6-13).

Based on the projected tasks in Figure 6-13, there are five proposed key capabilities for 2020:

- *Battle manager* for Force Application. Fully integrates surface, air, and space-based systems in near real time using the global defense information network, giving the NCA the best strike solution.
- *On-demand precision* Force Application. Applying force with decisive speed any place, anytime, augmenting Joint Vision 2010's concept of Precision Engagement.
- *Flexible* Force Application (*fixed, relocatable or moving targets*)–The NCA must be able to rapidly counter widely varying high-value targets (e.g., weapons of mass destruction). Flexible

POTENTIAL FORCE APPLICATION CONCEPT



- *C4ISR*–providing maximum worldwide situational awareness with all-source data from integration of land, sea, air and space systems.
- *Target Identification and Prioritization*–of high value target areas and homeland defense.
- *Mission Planning*–fully integrates surface, air and space-based systems via the global defense information network (GDIN).
- *Execution*–reliable command links under compressed cycle times and complex environments.
- *Assess and Report*–Automatic analysis; optimizes sensors to targets; global in nature; directs re-engagement when needed.
- *Reconstitute*–forces, particularly space forces to assure continued global coverage.
- *Weaponeering*–requires delivery platforms with unprecedented accuracy and an inventory of weapons capable of producing a wide variety of effects.

Figure 6-13 Key Tasks for Force Application

Force Application ideally will hold at risk 100 percent (2020 goal) of these fixed, relocatable, and moving high-value targets, thus opening windows of opportunity that other forces cannot exploit.

- *Flexible effects.* Rapid, precise force projection, featuring temporary and permanent effects. This kind of force limits destruction and offers the most operational agility to the NCA.

- *Combat assessment.* From all sources and in near real time; gauges mission success and the potential need to reengage.

Figure 6-14 depicts the proposed 2020 key capabilities and metrics for Force Application.

Force Application–Assessing Possible Systems-Concepts

- *BMC3 (2020 goal: near real time).* Programmed and planned systems will meet the proposed 2020 goals for BMC3. Availability and quick response are the unique attributes of these systems. To use them, all commanders and decision makers must readily access a common, integrated operating picture for land, sea, air, and space; and standardized planning tools, and common, linked execution paths. As discussed under battle management for Integrated Focused Surveillance, the USSPACECOM Battle Managers and the global defense information network provide these abilities.

- *On-demand* Force Application (*2020 goal: within minutes*). Research on evolving concepts such as Conventional Ballistic Missiles Common Aero Vehicle, Space-Based Platform, Space Operations Vehicle and Space-Based Laser may provide the basis for on-demand precision engagement from space. CBMs will offer the intermediate capability to deliver conventional precision weapons transiting space. This transitional opportunity may be a prelude to other concepts for Force Application. Should US vital interests be threatened and our civilian leadership decide response through the use of space systems is appropriate, time-critical targets can be struck by delivering conventional precision-guided weapons anywhere in the world within 90 minutes of launch. The Space Operations Vehicle's "first to the fight" capability assures the theater commanders maintain a distinct advantage while other forces are being deployed or generated to alert." The USSPACECOM Battle Managers and global defense information network will also provide crucial support.

- *Flexible* Force Application (*2020 goal: 100% of NCA-assigned [limited, varied] high value targets*). Around 2020, the same concepts described above will also be capable of providing the required flexibility to conduct surgical application of force from space against a wide array of high value targets. As with Missile Defense, the USSPACECOM Battle Managers and global defense information network will give all commanders a fully integrated picture of land, sea, air, and space operations and allow them to select and use the proper weapon.

- *Flexible effects (2020 goal: 30% non-lethal effects).* Once again, the same concepts described above are also applicable to generating non-lethal effects. Additionally, concepts such as the High Power Microwave may further expand the capability for projecting flexible effects.

FORCE APPLICATION	1998	2005	2012	2020
Capabilities				
• BMC3	Very Limited			Near Real Time
• On-Demand Force Application (Minutes)	N/A	Days		Minutes
• Flexible Force Application (Limited/Varied Target Set)	0	Limited	30-50%	100%
• Flexible Effects (Non-Lethal)	N/A	Limited		30%
• Combat Assessment	Hours		Near Real Time	100% Real Time

Figure 6-14 Force Application Capabilities and Goals for 2020

The USSPACECOM Battle Managers and global defense information network offer support for command and control identical to that for flexible Force Application.

- *Combat assessment (2020 goal: 100% in real time).* Programmed and planned systems will meet the goals for real time assessment by 2020. Force Application will rely much more than Missile Defense on Integrated Focused Surveillance to do battle assessment. Most potential Force Application systems won't have their own ability to perform battle assessment. Combat assessment will rely on USSPACECOM Battle Managers and global defense information network for fused information from all sources. This critical support will give commanders the information, status of forces, and planning tools to reattack if needed.

Figure 6-15 is a roadmap for research, and when appropriate, development of Force Application that, with NCA approval, could be deployed. It is primarily based on Missile Defense candidate systems and technologies which the Components, Services, and other agencies provided.

Force Application

Key Capabilities	Candidate Systems 98	05	12	20	Candidate Technologies
BMC3 (Near-Real-Time)		GE BM	GDIN, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition, HSI, USI, Advanced E/O, Moving Target Indicator
On-Demand Force Application (Minutes)	CBM ACTD, CBM (3 Assets), CBM with CAV	GE BM	SBL, GDIN, SOV, SBP, USSPACECOM BM		Ballistic Missile Replacement, HPM
Flexible Force Application (100% of Limited, Varied Target Set)	CBM ACTD, CBM (3 Assets), CBM with CAV	GE BM, GBL with Mirrors	SBL, GDIN, USSPACECOM BM		Ballistic Missile Replacement, HPM, Ordnance Technology, Advanced Fusing and Guidance Systems
Flexible Effects (30% Non-Lethal)	CBM with CAV	GE BM	SBL, GDIN, USSPACECOM BM		Ballistic Missile Replacement, HPM, Ordnance Technology, Advanced Fusing and Guidance Systems
Combat Assessment (100%) (Real-Time)		GE BM	SBL, GDIN, SBR, USSPACECOM BM		Auto Cross Cueing, Fusion, Auto Recognition, HSI, USI, Advanced E/O
CONOPS	USSPACECOM BM	GDIN			
Organizations			USSPACECOM BM		
Global Partnerships and Policies	Space Weapons Policy, Cross Theater ROE		Collective Security Treaties		

Figure 6-15 Force Application Roadmap

Force Application–CONOPS, Organizations, Global Partnerships and Policies

Concepts for Force Application are centered on global defense information network and USSPACECOM Battle Managers and are identical to those for Missile Defense.

Key organizations for Force Application relate to global defense information network and are the same as those discussed for Integrated Focused Surveillance and Missile Defense. Development and approval of the appropriate policies for Force Application, are the key issues for this capability. **We recognize that the NCA has the lead to define national policy in this area, and no capability can be implemented until the NCA directs this to occur. Our objective is to plan for the future, conduct appropriate research, and propose possible pathways to achieve this capability.** Key policy and partnership issues for Force Application are part of those for Missile Defense, where we addressed the need to reevaluate space policy in light of a new world situation. We advocate building coalition support for space-based defensive systems and 21st Century treaties. If successful, this construct will allow us to deploy potent defensive systems, but the source of the threat will remain. The next step is deploying systems for force application that add to collective security by strongly deterring rogue states.

Force Application–Overall Assessment

Many of the technologies, systems and CONOPS developed for a robust Missile Defense provide a significant springboard for Force Application capabilities. In the event that the NCA chooses to accomplish Force Application, the ongoing Missile Defense efforts and the research and development initiatives outlined in the plan would meet all mission requirements by 2020; so its rating is GREEN (Figure 6-16).

Space Operations Vehicles and Space-Based Platforms will support Force Application by offering increased responsiveness and versatility that will result in better coverage of potential targets. Thus, by 2008-2012, we should be able to meet part of the mission and achieve an overall rating of YELLOW. As with Missile Defense, Space Operations Vehicles and Space-Based Interceptors will use similar, if not identical payloads.

The Ballistic Missile Replacement, Space-Based Lasers and High Power Microwaves, will meet all mission requirements and turn the rating to GREEN in 2018 to 2020. The Ballistic Missile Replacement is essentially an improved replacement for the Conventional Ballistic Missile and will be compatible with whatever follows our fleet of intercontinental ballistic missiles. Lasers and High Power Microwaves offer nearly the same kind of support, and may fulfill potential Force Application missions.

Force Application—Technology Assessment

Pending NCA guidance, each of the systems proposed to support Force Application concepts require attention in many technology areas. Space-Based Lasers must be lightweight, consume little power, be very accurate and develop high energy. They'll also need to overcome atmospheric distortion. High Power Microwaves must use lightweight sources of highly efficiency radio-frequency energy. Both systems will need new spacecraft technologies to provide more power and extremely accurate pointing and tracking. Other areas that need technology improvements are advanced systems for guidance and navigation, high-speed processors, and techniques for stabilizing spacecraft. Geolocation accuracy is also critical. To hit a terrestrial target requires precise knowledge of the spacecraft's state vector (attitude, velocity, and acceleration). The systems we use now don't provide a precise enough state vector for Space-Based Lasers or High Power Microwaves. GPS receivers, star trackers, data processing, and data fusion are just some of the technologies that must improve to support these weapons.

Data processing, including precise algorithms, is critical for detecting, identifying, and tracking targets, as well as suppressing backgrounds. Concepts for Force Application systems will depend strongly on accurate sensors to detect targets, but we'll have this technology if we develop capabilities for Integrated Focused Surveillance.

To cover the world, Common Aero Vehicles must reenter at very large cross ranges and, therefore, be able to withstand very high thermal and aerodynamic loads. We'll need low-cost, durable, lightweight thermal materials, as well as advanced materials and structures, to meet this capability.

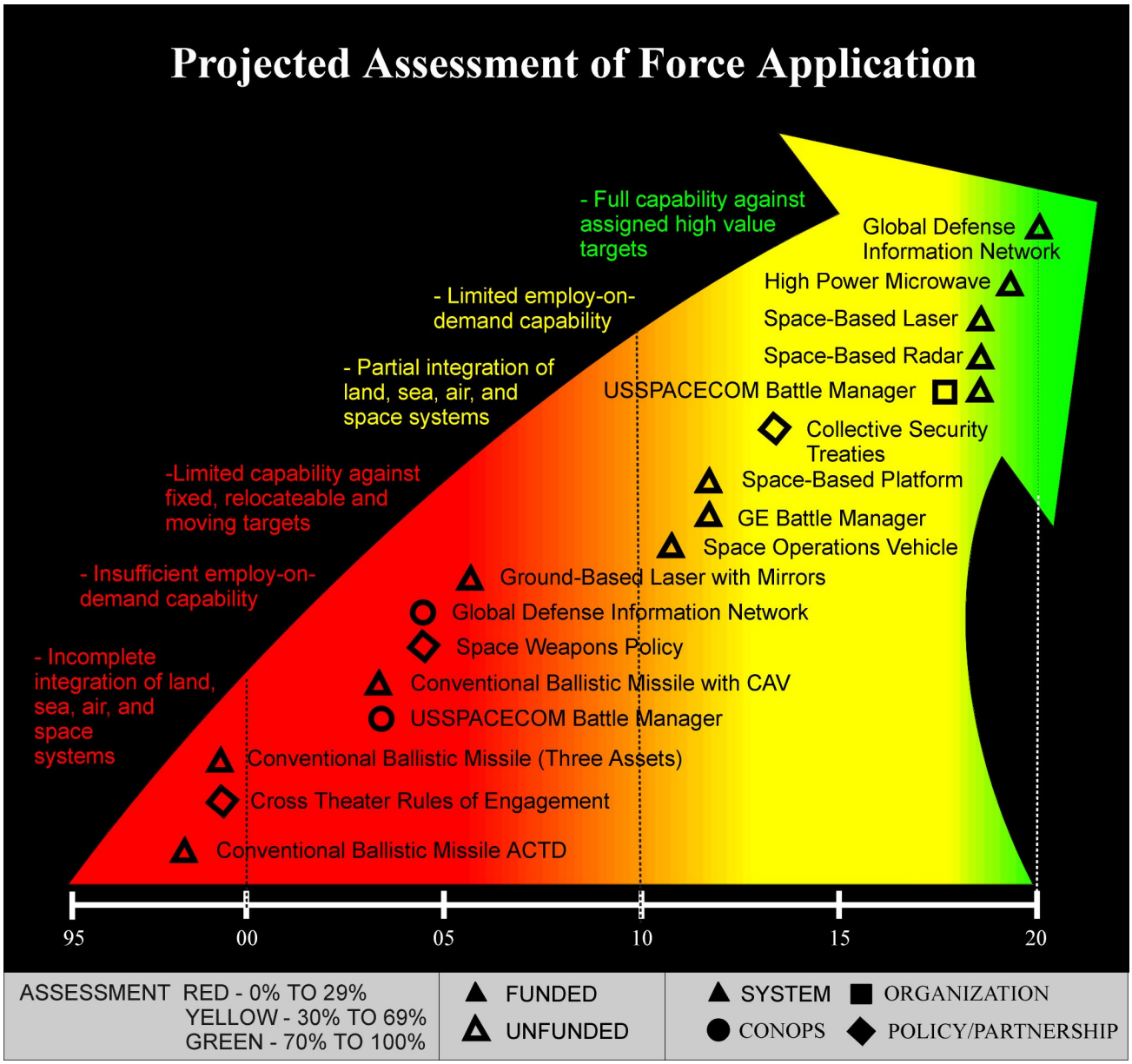


Figure 6-16 Assessment of Force Application

We'll also need innovative techniques to deploy the weapons these vehicles will carry.

Force Application–Recommendations and Directives

USCINCSPACE should address key issues on resources, requirements, and policies to explore Force Application concepts:

(**Directive**) Develop concepts for carrying out the Force Application mission. (SPJ5/AFSPC)

(**Directive**) Pursue research and development programs for Force Application as approved and consistent with national policy. (SPAN/AFSPC)

(**Directive**) Examine the Force Application mission through Title X and other wargame opportunities.

(**Directive/Recommendation**) Help develop Force Application system models and simulations to support tradespace analyses and policy implications. (N-SP/AN, SPJ3/5, Components)

(**Recommendation**) Establish a dialogue with appropriate government organizations on Force Application space policy. (SPJ5)

SUMMARY ASSESSMENT

The GREEN rating for Global Engagement depends on ratings of GREEN for Integrated Focused Surveillance, Missile Defense, and Force Application.

Integrated Focused Surveillance becomes GREEN in 2018, when we'll have robust sensors that can operate day and night in all weather, plus a fully capable global defense information network. Good coverage is available for theaters and other high-interest areas. We'll need to harness technology for Integrated Focused Surveillance to provide enough global coverage under tight budgets.

Missile Defense goes from RED to YELLOW in 2003, YELLOW to GREEN in 2008-2012, and reaches full capability in 2018-2020. Ground-Based Interceptors and theater defense systems marginally meet this mission and achieve a YELLOW rating. Space Operations Vehicles and Space-Based Platforms fully cover the mission, resulting in a GREEN rating. We project no shortfalls, but stealth technology could seriously impact Missile Defense capabilities. Policies must be reviewed, and in some cases modified, to achieve full capability.

The potential for adequate Force Application from space becomes YELLOW in 2008-2012 with the advent of Space Operations Vehicles and Space-Based Platforms and GREEN in 2018-2020 because we expect Space-Based Lasers and High Power Microwaves to be operational. We expect no shortfalls, but advanced techniques for countering surveillance could create problems by degrading accurate targeting information. Policy issues are very similar to those for Missile Defense.

Prioritized Capabilities

In this section we've ranked critical capabilities for Global Engagement. Listing the most important key capabilities will help focus the actions of USSPACECOM, Components and other organizations.

Critical Capabilities

Real Time Target Identification and Characterization (Integrated Focused Surveillance)
Ballistic and Cruise Missile Warning (Integrated Focused Surveillance)
Battle Management (All)
On Demand Missile Defense (Missile Defense)
Full Spectrum Engagement (Missile Defense)

Key Capabilities

Missile Defense Combat Assessment (Missile Defense)
Target Set Detection/Surveillance/Monitoring/Tracking (Integrated Focused Surveillance)
On Demand Force Application (Force Application)
Locating Ballistic Missile Launch Point and Impact Point Prediction (Integrated Focused Surveillance)
Flexible Force Application (Force Application)
Force Application Combat Assessment (Force Application)
Flexible Effects (Force Application)